IN THE CLAIMS

Please cancel claims 16 and 17, amend claims 1-4, 7-11 and 14-15, and add new claims 18-66 as follows:

1. (CURRENTLY AMENDED) A method for effecting gate operations using one or more semiconductor quantum bits ~~(102, 104)~~, wherein the semiconductor quantum bits ~~(102, 104)~~ are contained in a cavity ~~(126)~~, an electromagnetic field is applied to excite the semiconductor quantum bits ~~(102, 104)~~ to one or more energy levels ~~(200, 202, 204, 206)~~, and the semiconductor quantum bits ~~(102, 104)~~ so excited contain information used to implement the gate operations, the ~~improvement~~ method comprising:

coherently coupling the semiconductor quantum bits ~~(102, 104)~~ using a mode in the cavity ~~(126)~~ that has a resonant frequency substantially coincident with a transition between the energy levels ~~(200, 202, 204, 206)~~ of the semiconductor quantum bits ~~(102, 104)~~.

2. (CURRENTLY AMENDED) The method of claim 1, wherein the semiconductor quantum bits ~~(102, 104)~~ are arranged in an array.

3. (CURRENTLY AMENDED) The method of claim 1, wherein each of the semiconductor quantum bits ~~(102, 104)~~ is a quantum dot doped with a single electron.

4. (CURRENTLY AMENDED) The method of claim 3, wherein the information is represented by the states of an electron trapped in the quantum dot ~~(102, 104)~~.

5. (ORIGINAL) The method of claim 4, wherein the information is contained in a spin-state of the electron.

6. (ORIGINAL) The method of claim 5, further comprising the step of reading the information by determining the spin-state of the trapped electron.

7. (CURRENTLY AMENDED) The method of claim [[5]] 6, wherein the spin-state is determined by detecting selective fluorescent emissions from the trapped electron.

8. (CURRENTLY AMENDED) The method of claim 1, wherein the cavity ~~(126) for electromagnetic radiation~~ is a whispering-gallery-mode resonator.

9. (CURRENTLY AMENDED) The method of claim 1, wherein the cavity ~~(126) for electromagnetic radiation~~ is a defect in a photonic band-gap structure.

10. (CURRENTLY AMENDED) The method of claim 1, wherein the cavity ~~(126) for electromagnetic radiation~~ is a superconductor structure.

11. (CURRENTLY AMENDED) The method of claim 1, wherein the electromagnetic field includes a component generated by one or more laser beams ~~(430-436)~~.

12. (ORIGINAL) The method of claim 1, wherein the electromagnetic field includes a component generated by an externally applied magnetic field.

13. (ORIGINAL) The method of claim 1, wherein the gate operations result in a conditional NOT operation.

14. (CURRENTLY AMENDED) The method of claim 1, wherein the semiconductor quantum bits ~~(102, 104)~~ are vertically coupled quantum dots.

15. (CURRENTLY AMENDED) The method of claim 1, wherein the semiconductor quantum bits ~~(102, 104)~~ are horizontally coupled quantum dots.

16. (CANCELED)

17. (CANCELED)

18. (NEW) A quantum computing apparatus, comprising:

a cavity containing one or more semiconductor quantum bits; and

means for applying an electromagnetic field to the cavity to excite the semiconductor quantum bits to one or more energy levels, wherein the semiconductor quantum bits are coherently coupled using a mode in the cavity that has a resonant frequency substantially coincident with a transition between the energy levels of the semiconductor quantum bits.

19. (NEW) The apparatus of claim 18, wherein the semiconductor quantum bits are arranged in an array.

20. (NEW) The apparatus of claim 18, wherein each of the semiconductor quantum bits is a quantum dot doped with a single electron.

21. (NEW) The apparatus of claim 20, wherein the information is represented by the states of an electron trapped in the quantum dot.

22. (NEW) The apparatus of claim 21, wherein the information is contained in a spin-state of the electron.

23. (NEW) The apparatus of claim 22, further comprising means for reading the information by determining the spin-state of the trapped electron.

24. (NEW) The apparatus of claim 23, wherein the spin-state is determined by detecting selective fluorescent emissions from the trapped electron.

25. (NEW) The apparatus of claim 18, wherein the cavity is a whispering-gallery-mode resonator.

26. (NEW) The apparatus of claim 18, wherein the cavity is a defect in a photonic band-gap structure.

27. (NEW) The apparatus of claim 18, wherein the cavity is a superconductor structure.

28. (NEW) The apparatus of claim 18, wherein the electromagnetic field includes a component generated by one or more laser beams.

29. (NEW) The apparatus of claim 18, wherein the electromagnetic field includes a component generated by an externally applied magnetic field.

30. (NEW) The apparatus of claim 18, wherein the quantum computing apparatus performs gate operations that result in a conditional NOT operation.

31. (NEW) The apparatus of claim 18, wherein the semiconductor quantum bits are vertically coupled quantum dots.

32. (NEW) The apparatus of claim 18, wherein the semiconductor quantum bits are horizontally coupled quantum dots.

33. (NEW) A method of storing information in quantum states of electrons in semiconductor quantum bits comprising electron-doped quantum dots, wherein multiple quantum dots are located in a cavity excited by an electromagnetic field, the method comprising:

effecting a controlled NOT (CNOT) operation involving any pair of quantum dots by tuning energy levels of the quantum dots into resonance with frequencies of the cavity.

34. (NEW) The method of claim 33, wherein the energy levels of the quantum dots are tuned by voltages applied to gates across the quantum dots.

35. (NEW) The method of claim 33, wherein the energy levels of the quantum dots are tuned by pulses of electromagnetic radiation focused onto the quantum dots.

36. (NEW) The method of claim 33, wherein the semiconductor quantum bits are arranged in an array.

37. (NEW) The method of claim 33, wherein each of the semiconductor quantum bits is a quantum dot doped with a single electron.

38. (NEW) The method of claim 37, wherein the information is represented by the states of an electron trapped in the quantum dot.

39. (NEW) The method of claim 38, wherein the state of the electron is determined by detecting selective fluorescent emissions from the trapped electron.

40. (NEW) The method of claim 38, wherein the information is contained in a spin-state of the electron.

41. (NEW) The method of claim 40, further comprising the step of reading the information by determining the spin-state of the trapped electron.

42. (NEW) The method of claim 41, wherein the spin-state is determined by detecting selective fluorescent emissions from the trapped electron.

43. (NEW) The method of claim 33, wherein the cavity is a whispering-gallery-mode resonator.

44. (NEW) The method of claim 33, wherein the cavity is a defect in a photonic band-gap structure.

45. (NEW) The method of claim 33, wherein the cavity is a superconductor structure.

46. (NEW) The method of claim 33, wherein the electromagnetic field includes a component generated by one or more laser beams.

47. (NEW) The method of claim 33, wherein the electromagnetic field includes a component generated by an externally applied magnetic field.

48. (NEW) The method of claim 33, wherein the semiconductor quantum bits are vertically coupled quantum dots.

49. (NEW) The method of claim 33, wherein the semiconductor quantum bits are horizontally coupled quantum dots.

50. (NEW) A quantum computing apparatus, comprising:

a cavity excited by an electromagnetic field, wherein multiple semiconductor quantum bits comprising electron-doped quantum dots are located in the cavity; and

means for effecting a controlled NOT (CNOT) operation involving any pair of quantum dots by tuning energy levels of the quantum dots into resonance with frequencies of the cavity.

51. (NEW) The apparatus of claim 50, wherein the energy levels of the quantum dots are tuned by voltages applied to gates across the quantum dots.

52. (NEW) The apparatus of claim 50, wherein the energy levels of the quantum dots are tuned by pulses of electromagnetic radiation focused onto the quantum dots.

53. (NEW) The apparatus of claim 50, wherein the semiconductor quantum bits are arranged in an array.

54. (NEW) The apparatus of claim 50, wherein each of the semiconductor quantum bits is a quantum dot doped with a single electron.

55. (NEW) The apparatus of claim 54, wherein the information is represented by the states of an electron trapped in the quantum dot.

56. (NEW) The apparatus of claim 55, wherein the state of the electron is determined by detecting selective fluorescent emissions from the trapped electron.

57. (NEW) The apparatus of claim 55, wherein the information is contained in a spin-state of the electron.

58. (NEW) The apparatus of claim 57, further comprising means for reading the information by determining the spin-state of the trapped electron.

59. (NEW) The apparatus of claim 58, wherein the spin-state is determined by detecting selective fluorescent emissions from the trapped electron.

60. (NEW) The apparatus of claim 50, wherein the cavity is a whispering-gallery-mode resonator.

61. (NEW) The apparatus of claim 50, wherein the cavity is a defect in a photonic band-gap structure.

62. (NEW) The apparatus of claim 50, wherein the cavity is a superconductor structure.

63. (NEW) The apparatus of claim 50, wherein the electromagnetic field includes a component generated by one or more laser beams.

64. (NEW) The apparatus of claim 50, wherein the electromagnetic field includes a component generated by an externally applied magnetic field.

65. (NEW) The apparatus of claim 50, wherein the semiconductor quantum bits are vertically coupled quantum dots.

66. (NEW) The apparatus of claim 50, wherein the semiconductor quantum bits are horizontally coupled quantum dots.

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